MEASUREMENTS OF SOLAR RADIATION AT MAWSON, ANTARCTICA 1954

by Hans J. Albrecht (*) & Robert Dingle (**)

Summary — This paper describes solar-radiation measurements taken at Mawson during the first year of operation of this Australian Antarctic base. Following details of the instrument used and a description of the site, the results are presented and discussed.

Zusammenfassung — Diese Arbeit beschreibt Sonnenstrahlungsmessungen, die während des ersten Betriebsjahres der australischen antarktischen Station Mawson dort durchgeführt wurden. Den Beschreibungen des Meßgerätes und der Lage der Station folgen zusammengefaßte Tabellen der Ergebnisse und eine Diskussion derselben.

1. Introduction — Radiation measurements at Mawson (67°36'21" S; 62°52'48" E) commenced early in 1954, soon after this station of the A.N.A.R.E. (Australian National Antarctic Research Expedition) had been established. In view of the difficulties encountered with apparatus used in Antarctica, special radiation instruments were designed by one of the authors (H.J.A.) who was also responsible for general planning of the radiation work, and calculation and discussion of results in this paper.

1954 being the first year of operation of Mawson, the use of recording instruments for radiation research was not contemplated. Instead, instruments were intended for regular readings only. A special design was necessary to satisfy the main requirements, viz.: standard accuracy and adequate reliability under rough conditions.

The actual radiation observations were conducted, outside the official meteorological programme, by one of the authors (R.D.) who was the meteorological officer at Mawson in 1954.

2. The Actinometer — Simplicity of operational procedure being a major objective, the actinometer was designed as a self-contained instrument, housed in a desk-type cabinet. The actinometer is equipped with a ball-and-socket stand

(*) Now at the Istituto Geofisico e Geodetico, Università di Genova.
(**) A.N.A.R.E. Station, Vestfold Hills, Antarctica.
with a hinge as base. This enables the tube, which is kept inside the cabinet when not in use, to be swung into position on top of the cabinet, after the back-panel of the cabinet has been opened.

The tube can then be directed towards the sun by adjusting the ball-and-socket stand, the correct direction being indicated by a black-spot sight. Galvanometer and switches are located on the front-panel.

The actinometer tube contains three tubes of smaller diameter which were fitted into the actinometer tube in a triangular fashion. These tubes are covered by clear glass (Schott WG 6), yellow (OG 1) and red (RG 2) filters, respectively. A bolometer is accommodated in the bottom section of each internal tube, inside the actinometer tube. This type of design was chosen in order to provide maximum wind protection at minimum interaction between bolometers.

As depicted in Fig. 1, the three bolometers are connected to the galvanometer through the selector switch. The other positions of this switch operate the resistance bridge measuring the instrument temperature and change the galvanometer to a normal ammeter for the measurement of the battery current. This position

Fig. 1 - Antarctic Actinometer: Circuit diagram:

- $R_1$, $R_2$, and $R_3$ temperature-sensitive resistors (copper), 100 ohms, exposed to radiation
- $R_4$, $R_5$, $R_6$, and $R_7$ temperature-sensitive resistors (copper), 100 ohms, unexposed
- $R_H$ heating resistor for self-calibration
- $R_8$, $R_9$, and $R_{10}$ resistors, 100 ohms (constantan)
- $R_{11}$, $R_{12}$ galvanometer shunt resistances
- $S_1$, $S_2$, $S_3$ one three-bank switch
- $S_4$ polarity switch
- Key push-button
- Galv. galvanometer
- Bat. 4.5 volts

thus ensures a constant check of the condition of the battery. A second switch permits the polarity of the galvanometer to be reversed.